

**CLAIMS**

What we claim is:

1. A process for the production of an electrolytic electrode having  
5 an electrocatalytic coating thereon, said electrocatalytic coating having a  
surface morphology adapted for enhanced electrode efficiency, said process  
comprising the steps of:  
    providing a valve metal electrode base;  
    coating said valve metal electrode base with a coating layer of an  
10 electrochemically active coating on said valve metal electrode base, said  
coating consisting essentially of a mixture of ruthenium oxide, titanium oxide  
and one or more of tin oxides or antimony oxides, said mixture providing from  
at least about 10 mole percent up to about 30 mole percent ruthenium, and at  
least about 50 mole percent up to about 85 mole percent titanium, basis 100  
15 mole percent of the metal content in the coating, wherein said surface  
morphology of said coating is characterized by minimal mudcracks, and  
wherein said electrode produces less than about 2.0% oxygen in a chlorate  
electrolyte.
- 20 2. The process of claim 1, wherein said valve metal electrode  
base is one or more of titanium, tantalum, zirconium, niobium, tungsten,  
aluminum, their alloys and intermetallic mixtures, and said base is in mesh,  
sheet, blade, tube or wire form.
- 25 3. The process of claim 1, wherein a surface of said valve  
metal electrode base is a prepared surface.
4. The process according to claim 3, wherein said surface is  
prepared as by one or more of etching, intergranular etching, grit blasting, or  
30 thermal spraying.
5. The process of claim 2, wherein said ruthenium oxide is  
present in an amount from about 10 mole percent up to about 25 mole

percent, and said titanium is present in an amount from about 60 mole percent up to about 75 mole percent, basis 100 mole percent of the metal content of the coating.

5           6.           The process of claim 1, wherein said coating contains from about 5 mole percent up to about 20 mole percent antimony oxide basis 100 mole percent of the metal content of the coating.

10           7.           The process of claim 1, wherein said coating contains from about 2 mole percent up to about 20 mole percent tin oxide, basis 100 mole percent of the metal content of the coating.

15           8.           The process of claim 5, wherein said coating contains from about 10 mole percent up to about 15 mole percent antimony oxide and from about 2 mole percent up to about 15 mole percent tin oxide, basis 100 mole percent of the metal content of the coating.

20           9.           The process of claim 1, wherein the ratio of ruthenium metal to antimony or tin is from about 2:1 to about 0.1:1 and the ratio of titanium metal to antimony or tin is from about 19:1 to about 1:1.

25           10.          The process of claim 1, wherein said surface morphology of said coating provides, as measured by scanning electron microscopy, from about less than or equal to 16,000 platelets/mm<sup>2</sup>.

          11.          The process of claim 10, wherein said surface morphology of said coating provides, as measured by scanning electron microscopy, from about 100 to about 12,000 platelets/mm<sup>2</sup>.

30           12.          The process of claim 1, wherein said coating is a water-based coating.

13. The process of claim 1, wherein said electrode is an anode in an electrolytic process for the production chlorate.

14. The process according to claim 1, wherein said process  
5 further comprises the step of heating said coating and said heating is by baking at a temperature of from about 425°C to about 525°C for a time of from about 3 minutes up to about 20 minutes.

15. The process of claim 1, wherein said coating composition  
10 further includes iridium oxide in an amount from about 1 mole percent up to about 25 mole percent, basis 100 mole percent of the metal content of the coating, and the ratio of ruthenium metal to iridium is from about 1:1 to about 99:1.

16. A metal article of a valve metal substrate for use in  
15 electrocatalytic processes, said valve metal substrate having an electrocatalytic surface coating thereon, wherein said coating consists essentially of a mixture of ruthenium oxide, titanium oxide and one or more of tin oxides or antimony oxides, said mixture providing from at least about  
20 mole percent up to about 30 mole percent ruthenium, and at least about 50 mole percent up to about 85 mole percent titanium, basis 100 mole percent of the metal content in the coating, wherein said surface morphology of said coating is characterized by minimal mudcracks.

17. The metal article of claim 16, wherein said valve metal  
25 substrate is one or more of titanium, tantalum, zirconium, niobium, tungsten, aluminum, their alloys and intermetallic mixtures, and said substrate is in mesh, sheet, blade, tube or wire form.

18. The metal article of claim 16, wherein a surface of said  
30 valve metal electrode base is a prepared surface.

19. The metal article of claim 18, wherein said surface is prepared as by one or more of etching, intergranular etching, grit blasting, or thermal spraying.

5 20. The metal article of claim 17, wherein said ruthenium oxide is present in an amount from about 10 mole percent up to about 25 mole percent, and said titanium is present in an amount from about 60 mole percent up to about 75 mole percent, basis 100 mole percent of the metal content of the coating.

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21. The metal article of claim 16, wherein said coating contains from about 5 mole percent up to about 20 mole percent antimony oxide basis 100 mole percent of the metal content of the coating.

15 22. The metal article of claim 16, wherein said coating contains from about 2 mole percent up to about 20 mole percent tin oxide, basis 100 mole percent of the metal content of the coating.

20 23. The metal article of claim 16, wherein said coating contains from about 10 mole percent up to about 15 mole percent antimony oxide and from about 2 mole percent up to about 15 mole percent tin oxide, basis 100 mole percent of the metal content of the coating.

25 24. The metal article of claim 16, wherein the ratio of ruthenium metal to antimony or tin is from about 2:1 to about 0.1:1 and the ratio of titanium to antimony or tin is from about 19:1 to about 1:1.

30 25. The metal article of claim 16, wherein said surface morphology of said coating provides, as measured by scanning electron microscopy, from about less than or equal to 16,000 platelets/mm<sup>2</sup>.

26. The metal article of claim 25, wherein said surface morphology of said coating provides, as measured by scanning electron microscopy, from about 100 to about 12,000 platelets/mm<sup>2</sup>.

5 27. The metal article of claim 16, wherein said coating is a water-based coating.

28. The metal article of claim 16, wherein said electrode is an anode in an electrolytic process for the production of one or more of chlorine, chlorate, hypochlorite, or for the oxidation of a soluble species.  
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29. The metal article of claim 16, wherein said coating further includes iridium oxide in an amount from about 1 mole percent to about 25 mole percent, basis 100 mole percent of the metal content of the coating, and  
15 the ratio of ruthenium metal to iridium is from about 1:1 to about 99:1.